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Rejections Under 35 USC §112, second paragraph

Claims 78-82, 87, 88, 90-93 and 96-98 have been rejected under 35 USC §112, second paragraph, as being indefinite. These rejections are based on the recitation of "height" in independent claims 78, 87, 92 and 97.

The rejections under 35 USC §112, second paragraph, are traversed. However, independent claims 78, 87, 92 and 97 have been amended to state that the substrate includes a "surface", and that the bumps have a "height on the surface". The "surface" in the claims is surface 49 described on page 16, line 23 of the specification, and shown in Figure 6. In addition, antecedent basis for term "height" in describing the bumps, is contained on page 9, lines 7-8 of the specification.

In support of the rejections the Office Action states: "The use of the word "height" in the claims is not clear. Applicants' remarks in the amendment filed June 16, 2003 seem to be attempting to give the word "height" some special meaning and the Examiner is not sure what it is."

In response, Applicant submits that no special meaning is intended for the "height" recitations. Rather, "height" is intended to denote the distance from the surface 49 of the substrate 41 to the top of the bump 61 in Figure 6 (i.e., the distance from the surface 49 to the tips of the raised portions 73).

As held in In re Okuzawa, 537 F.2d 563, 190 USPQ 464 (CCPA 1976), claims are to be read in light of the specification. In the context of the present specification the term "height" in referring to the bumps 61 is submitted to be clear.

With regard to the statements in the previous Amendment on "height", the Agahdel et al. contacts comprise pads 40 in a polymer layer 39 with particles projecting from the pads 40. These particles would not have the same height, as with the bumps that form the presently claimed contacts. Rather, the particles would project from the pads with a random height. The present bumps are uniform and present precise structures, rather than random particles, for making electrical contact with the pads on the die. Further, as shown in Figure 6 of the present application, one benefit of the height of the bumps 61 is that the die 21 is spaced from the surface 49 of the substrate 41 by a uniform distance, which is approximately equal to the height of the bumps 61.

Rejections Under 35 USC §103(a)

Claims 78-82, 87, 88, 90-93 and 96-98 have been rejected under 35 USC §103(a) as being unpatentable over Nakano (JP Hei 3-69131) in view of Blonder et al. (US Patent No. 4,937,653) and Agahdel et al. (US Patent No. 5,402,077).

The rejections under 35 USC §103(a) are traversed for the reasons to follow. In addition, the claims have been amended to recite features which further distinguish the claimed apparatus from the prior art. Further, a "Claim Chart" with a reading of the claims on the specification and drawings is attached to this Amendment.

Summary of the Invention

The amended claims are directed to an apparatus ***(burn-in fixture 11-Figure 8)*** for testing a semiconductor die ***(die 21-Figure 6)*** having a plurality of pads ***(bondpads 27-***

Figure 6). The apparatus includes a plate ***(die cavity plate 13-Figure 8)*** for retaining the die, a substrate ***(substrate 41-Figure 6)*** configured to make temporary electrical connections with the die ***(die 21-Figure 6),*** and a biasing member ***(elastomeric strip 83-Figure 8)*** configured to bias the die ***(die 21-Figure 6)*** against the substrate ***(substrate 41-Figure 6)*** with a biasing force.

The substrate ***(substrate 41-Figure 6)*** includes contacts ***(bumps 61-Figure 6)*** with raised portions ***(raised portions 73-Figure 6)*** for penetrating the pads ***(bondpads 27-Figure 6)*** on the die ***(die 21-Figure 6)*** to a self limiting penetration depth. The contacts ***(bumps 61-Figure 6)*** are constructed such that a biasing force with which the biasing member ***(elastomeric strip 83-Figure 8)*** presses the die ***(die 21-Figure 6)*** and the substrate ***(substrate 41-Figure 6)*** together is sufficient to cause the raised portions ***(raised portions 73-Figure 6)*** on the contacts ***(bumps 61-Figure 6)*** to penetrate the pads ***(bondpads 27-Figure 6)*** on the die ***(die 21-Figure 6)***. This is the lower limit of the biasing force. At the same time, the biasing force is selected to be less than a force required for the remaining portions of the contacts ***(bumps 61-Figure 8)*** to penetrate the pads ***(bondpads 27-Figure 6)*** on the die ***(die 21-Figure 6)***. This is the upper limit of the biasing force.

35 USC §103 Rejections Over Nakano, Blonder et al. and Agahdel et al.

In the amended claims the "clamping mechanism" recitations have been replaced with "biasing member" recitations. The biasing member is the elastomeric strip 83 shown in Figure 8. Antecedent basis for the term biasing member is contained on page 21, line 17 of the specification.

Neither Nakano, nor Blonder et al., teach an apparatus having a biasing member for biasing pads on the die into electrical contact with contacts on a substrate. Agahdel et al. was cited as teaching "a clamping mechanism" in Figures 1, 6 and 10-14, which would also perform a biasing function.

However, the present claims have a priority date of 11/05/1991 on this feature, which is earlier than 11/20/1992 the filing date of Agahdel et al. In this regard, the present application is a CIP of US Patent No. 5,440,240 filed on 11/05/1991. The '240 patent shows both a clamping mechanism (clamp 71) and a biasing member (backing strip 95 described at column 7, lines 55-58). The 35 USC §103(a) rejections are thus traversed because Agahdel et al. is not prior art as to the cited teaching.

The 35 USC §103 rejections are also traversed because the references do not teach or suggest all of the features of the present claims. Further, one skilled in the art would have no incentive to combine the references in the manner of the Office Action.

The present test apparatus includes a substrate with contacts having a self limiting penetration depth. In addition, the present test apparatus relates the self limiting nature of the contacts to the biasing force applied by a biasing member of the apparatus.

Specifically, the raised portions (73-Figure 6) of the contacts (bumps 61-Figure 8) penetrate the pads (27-Figure 6) on the die (21-Figure 6) at the selected biasing force, while the remainder of the contacts (e.g., the flat surface on the bump 61 in Figure 6) provide a stop plane for limiting further penetration. Damage to the die is thus limited, and the upper and lower limits of the biasing force applied by the biasing member can be quantified.

Applicant submits that the feature of a penetration limiting contacts, in combination with a biasing member configured to generate a selected biasing force, is not taught or suggested by the cited art. Applicant further submits that the feature of relating a biasing force applied by a biasing member to the structure of the penetration limiting contacts is not taught or suggested by the cited art. These features are recited in each independent claim (claims 78, 87, 92 and 97).

The Nakano reference has been cited as teaching a penetration limiting contact. In support of the rejections the Office Action states: "The apparatus of Nakano would inherently have to have a clamping mechanism to hold a die against the probes on the substrate 10 because pressure has to be applied in order to make proper contact".

However, Nakano is directed to a probe card, such that the biasing force for biasing the contact with the wafer is externally generated by something other than a biasing member on a plate which holds the die, as presently claimed. For example, probe cards typically include external force applying members, such as hydraulic cylinders, which apply the biasing force to the probe card. In addition, there is no suggestion in Nakano of relating a

biasing force applied by a biasing member to the structure of the penetration limiting contact.

Blonder et al. teaches a permanent connection system that requires "bonding of the carrier pads to the chip pads" (col. 2, lines 40-41). Because Blonder et al. is a permanent connection system one skilled in the art at the time of the invention would have no incentive to modify the Nakano probe card with "plural raised portions" as taught by Nakano. Further, Blonder et al. does not relate contact force to penetration depth. Rather, as explained at column 4, lines 49-55 of Blonder et al., an external mechanical pressure is applied to the chips and carrier. This pressure can be mechanically controlled, and a special contact structure to limit the penetration depth, as a function of contact pressure is not required.

In citing Blonder et al. the Office Action states "Blonder et al. discloses cold welding but also intends that the parts may be separated by tugging at them. See column 5 lines 1-20 of Blonder et al. It is noted that Applicant's apparatus will inherently cold weld."

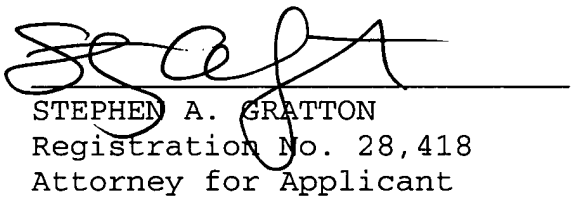
However cold welding and pulling apart are unacceptable procedures for testing applications where the object is to cause as little damage as possible to the dice. Further, the statement that Applicant's apparatus will inherently cold weld is disputed, as cold welding is a function of materials and contact forces. In this regard, Blonder et al. teaches gold to gold materials (column 4, line 9) and high contact forces (column 4, lines 50-51). The present claims recite neither of these features.

Conclusion

In view of the amendments and arguments, favorable consideration and allowance of claims 78-82, 87, 88, 90-93 and 96-98 is requested. An Information Disclosure Statement is being filed concurrently with this Amendment. Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

DATED this 10th day of October 2003.

Respectfully submitted:



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CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class mail in an envelope addressed to: Mail Stop Non Fee Amendment, Commissioner For Patents, PO Box 1450, Alexandria, VA on this 10th day of October, 2003.

October 10, 2003
Date of Signature

Stephen A. Gratton
Attorney for Applicants

CLAIM CHART

Attachment to Amendment dated October 10, 2003 to US Patent application serial no. 08/838,452

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
78. An apparatus	burn-in fixture 11 first described on page 13, lines 9-10 and shown in Figures 1 and 2, also described as an "apparatus" at page 1, line 10
for testing a semiconductor die	die 21 first described on page 13, line 13 and shown in Figure 6
having a plurality of pads	bondpads 27 first described on page 13, line 14 and shown in Figure 6
comprising:	
a plate;	die cavity plate 13 first described on page 13, line 10 and shown in Figure 8
a substrate	substrate 41 first described on page 14, lines 8-10 and shown in Figure 6
on the plate	die cavity plate 13 first described on page 13, line 10 and shown in Figure 8
comprising a surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6
and a plurality of contacts	bumps 61 first described on page 17, line 19 and shown in Figure 6, and also described as alternate embodiments of the die contacts 43 on page 16, lines 7-8
on the surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6
configured to electrically contact the pads; and	page 14, lines 11-12

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CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
a biasing member on the plate	elastomeric strip 83 shown in Figure 8 and described as a "biasing member" at page 21, line 17
configured to bias the contacts and the pads together with a force;	antecedent basis for "force" on page 17, line 27 and page 21, line 3
the plate,	die cavity plate 15 shown in Figure 8
the substrate	substrate 41 shown in Figure 6
and the biasing member	elastomeric strip 83 shown in Figure 8
configured such that the die can be placed on the substrate and biased against the substrate with the contacts in electrical contact with the pads	page 17, lines 1-3 and page 14, lines 10-12
each contact comprising a bump	bump 61-Figure 6
on the substrate	substrate 41-Figure 6
having a height	page 9, lines 7-8
on the surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
and a plurality of raised portions	raised portions 73 first described on page 17, line 20 and shown in Figure 6
dimensioned to penetrate into a pad to a penetration depth less than a thickness of the pad,	page 17, line 21 and page 18, lines 1-3
the bump dimensioned to limit further penetration of the raised portions into the pad at the force.	page 17, lines 25-30 and page 9, lines 12-15
79. The apparatus of claim 78 wherein the bump is dimensioned to penetrate into the pad at a second force which is greater than the force.	page 17, lines 25-30
80. The apparatus of claim 78 further comprising a plurality of conductive traces on the substrate in electrical communication with the contacts,	conductive traces 45 first described on page 14, lines 14-15 and shown in Figure 6
and a plurality of external leads on the plate in electrical communication with the traces	external connector leads 33 first described on page 13, line 20 and shown in Figure 8

CLAIM CHART

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CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
81. The apparatus of claim 78 wherein the substrate comprises silicon and the bump comprises metal.	page 14, line 14 page 16, line 8
82. The apparatus of claim 78 wherein the pads comprise bondpads.	bondpads 27 first described on page 13, line 14
87. An apparatus	burn-in fixture 11 first described on page 13, lines 9-10 and shown in Figures 1 and 2, and described as an "apparatus" at page 1, line 10
for testing a semiconductor die	die 21 first described on page 13, line 13 and shown in Figure 6
having a plurality of pads	bondpads 27 first described on page 13, line 14 and shown in Figure 6
comprising:	
a plate	die cavity plate 13 first described on page 13, line 10 and shown in Figure 8
comprising a plurality of external leads;	external connector leads 33 first described on page 13, line 20 and shown in Figure 8
a substrate	substrate 41 first described on page 14, lines 8-10 and shown in Figure 6

CLAIM CHART

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CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
on the plate	die cavity plate 13 first described on page 13, line 10 and shown in Figure 8
comprising a surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6
a plurality of contacts	bumps 61 first described on page 17, line 19 and shown in Figure 6, and also described as alternate embodiments of the die contacts 43 on page 16, lines 7-8
on the surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6
configured to electrically contact the pads;	page 14, lines 11-12
and a biasing member on the plate	elastomeric strip 83 shown in Figure 8 and described as a "biasing member" at page 21, line 17
configured to bias the contacts and the pads together with a force;	antecedent basis for force on page 17, line 27 and page 21, line 3
the plate,	die cavity plate 15 shown in Figure 8
the substrate	substrate 41 shown in Figure 6
and the biasing member	elastomeric strip 83 shown in Figure 8

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
configured such that the die can be placed on the substrate and biased against the substrate with the contacts in electrical contact with the pads	page 17, lines 1-3 and page 14, lines 10-12
each contact comprising a bump	bump 61-Figure 6
on the substrate	substrate 41-Figure 6
having a height	page 9, lines 7-8
on the surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6
and a plurality of spaced points	raised portions 73 shown in Figure 6 and described as points on page 9, line 9
on the bump	bump 61-Figure 6
configured to penetrate into a pad with a penetration depth less than a thickness of the pad while a remainder of the bump limits further penetration,	page 17, line 21 and page 18, lines 1-3
the force selected to be greater than a first force at which the points penetrate the pad but less than a second force at which the remainder of the bump penetrates the pad.	page 17, lines 25-30 and page 9, lines 12-15

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
88. The apparatus of claim 87 wherein the substrate comprises silicon and the bump comprises metal.	page 14, line 14 page 16, line 8
90. The apparatus of claim 87 wherein the bump comprises a second surface and the raised portions project from the surface.	surface of bump 61 with raised portions 73 shown in Figure 6
91. The apparatus of claim 87 further comprising a plurality of conductive traces	conductive traces 45 first described on page 14, lines 14-15 and shown in Figure 6
on the substrate	substrate 41-Figure 6
and a plurality of bond pads	substrate bondpads 47 first described on page 14, line 15 and shown in Figure 6
on the conductive traces.	conductive traces 45 first described on page 14, lines 14-15 and shown in Figure 6
92. An apparatus	burn-in fixture 11 first described on page 13, lines 9-10 and shown in Figures 1 and 2, and described as an "apparatus" at page 1, line 10
for testing a semiconductor die	die 21 first described on page 13, line 13 and shown in Figure 6
having a plurality of pads	bondpads 27 first described on page 13, line 14 and shown in Figure 6
comprising:	
a plate;	die cavity plate 13 first described on page 13, line 10 and shown in Figure 8

CLAIM CHART

Attachment to Amendment dated October 10, 2003 to US Patent application serial no. 08/838,452

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
a substrate	substrate 41 first described on page 14, lines 8-10 and shown in Figure 6
on the plate	die cavity plate 13 first described on page 13, line 10 and shown in Figure 8
comprising a surface	surface 49 first described on page 16, line 23 of the specification as shown in Figure 6
a plurality of contacts	bumps 61 first described on page 17, line 19 and shown in Figure 6, and and also described as alternate embodiments of the die contacts 43 on page 16, lines 7-8
on the surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6
configured to electrically contact the pads;	page 14, lines 11-12
and a biasing member on the plate	elastomeric strips 83 shown in Figure 8 and described as a biasing "member" at page 21, line 7
configured to bias the contacts and the pads together with a force;	antecedent basis for force on page 17, line 27 and page 21, line 3
the plate,	die cavity plate 15 shown in Figure 8
the substrate	substrate 41 shown in Figure 6
and the biasing member	elastomeric strip 83

CLAIM CHART

Attachment to Amendment dated October 10, 2003 to US Patent application serial no. 08/838,452

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
configured such that the die can be placed on the substrate and biased against the substrate with the contacts in electrical contact with the pads	page 17, lines 1-3 and page 14, lines 10-12
each contact comprising a bump	bump 61-Figure 6
on the substrate	substrate 41-Figure 6
having a height and	page 9, lines 7-8
on the surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6
and a plurality of spaced raised portions	raised portions 73 first described on page 17, line 20 and shown in Figure 6
dimensioned to penetrate into a pad at the force by a penetration depth less than a thickness of the pad	page 17, line 21 and page 18, lines 1-3
while the bump limits further penetration into the pad,	page 17, lines 25-30 and page 9, lines 12-15
the force selected to be greater than a first force at which the raised portions penetrate the pad but less than a second force at which the bump penetrates the pad.	page 17, lines 25-30 and page 9, lines 12-15

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
93. The apparatus of cliam 92 further comprising a plurality of external leads on the plate in electrical communication with the contacts.	external connector leads 33 first described on page 13, line 20 and shown in Figure 8
96. The apparatus of claim 92 wherein the raised portions comprise points.	page 9, line 9
97. An apparatus	burn-in fixture 11 first described on page 13, lines 9-10 and shown in Figures 1 and 2, and described as an "apparatus" at page 1, line 10
for testing a semiconductor die	die 21 first described on page 13, line 13 and shown in Figure 6
having a pad	bondpads 27 first described on page 13, line 14 and shown in Figure 6
with a thickness	page 18, lines 1-3
comprising:	
a plate;	die cavity plate 13 first described on page 13, line 10 and shown in Figure 8
a substrate	substrate 41 first described on page 14, lines 8-10 and shown in Figure 6
on the plate	die cavity plate 13 first described on page 13, line 10 and shown in Figure 8
comprising	
a surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
and a contact on the surface configured to electrically contact the pad, the contact comprising a bump	bumps 61 first described on page 17, line 19 and shown in Figure 6, and also described as alternate embodiments of the die contacts 43 on page 16, lines 7-8
having a height	page 9, lines 7-8
on the surface	surface 49 first described on page 16, line 23 of the specification and shown in Figure 6
and a plurality of points comprising portions of the bump projecting therefrom,	raised portions 73 shown in Figure 6 and described as points on page 9, line 9
the points configured such that the points can penetrate into the pad to a penetration depth less than the thickness while a remainder of the bump limits further penetration into the pad;	page 17, lines 19-30 and page 9, lines 12-15
and a biasing member on the plate	elastomeric strip 83 shown in Figure 8 and described as a "biasing member" at page 21, line 17

CLAIM	SPECIFICATION SUPPORT IN 08/838,452 APPLICATION
configured to bias the die and the substrate together with a force selected to achieve penetration of the pad by the points to the penetration depth.	page 17, lines 25-30 and page 18, lines 1-3

98. The apparatus of claim 97 wherein the substrate comprises silicon	page 14, line 14
and the bump comprises metal.	page 16, line 8